Patent Claims

1. Optical zoom system specifically for a confocal light scanning electron microscope, which, in the illuminating beam path (IB) [BS] of the microscope (1), is connected in front of the objective (21) capturing the object (23), which produces an intermediate image (II) [(ZB1]of the object and which images/forms an entrance pupil (En.P) [EP] of the illuminating beam path with variable magnification (m) [v] and/or with variable imaging length (L) [L] into an exit pupil (Ex.P) [AP].

2. Optical zoom system in accordance with claim 1, whereby in the exit pupil (Ex.P.) [AP] is arranged an element acting as an aperture (42), which affects a size of the exit pupil (Ex.P.) [AP] that is independent from the selected setting on the optical zoom system, wherein the size of the exit pupil (Ex.P.) [AP] is preferably smaller than the size of the entrance pupil (En.P.) [OP] of the objective.

3. Optical zoom system in accordance with claim 2, whereby the element acting as an aperture (42) exhibits a scanner mirror (18), an iris diaphragm or an aperture mechanism with different interchangeable pinhole apertures.

4. Optical zoom system in accordance with one of the claims 1 through 3, which is adjustably controllable by means of a control unit, wherein the control unit produces variable magnification (m) [v] in a first mode of operation while maintaining a constant image length (L) [L] and produces a variable image length in a second mode of operation while maintaining constant magnification (m) [v].

5. Optical zoom system in accordance with one of the claims 1 through 4, exhibiting four optical groups (G1 - G4), whereby seen in the direction counter to illumination, the optical groups (G1 - G4) have positive (G1), negative (G2), positive (G3) and once again positive (G4) refracting power, and a drive is provided for positioning at least three of the optical groups (G2 - G4).

6. Optical zoom system in accordance with claim 5, whereby each optical group (G1 - G4) is self-correcting relative to image defects/imaging errors.

7. Confocal scanning electron microscope with an optical zoom system (41) in accordance with one of the claims 1 through 6.

8. Confocal scanning electron microscope in accordance with claim 7 with confocal multiple spot imaging, specifically by means of a Nipkow disc (64), of a confocal slotted aperture (26) or of a multiple point light source.

9. Confocal scanning electron microscope in accordance with claim 7 or 8 with a resonance scanner.

10. Confocal scanning electron microscope in accordance with one of the claims 7 through 9 with an Abbe König prism in the proximity of a pupil, more specifically located in the proximity of the exit pupil (Ex.P.) [AP], and said prism being rotatable in the beam path.

11. Use of configurations in accordance with at least one of the preceding claims for analyzing developmental processes, in particular, dynamic processes ranging from tenths of seconds to hours, in particular, at the level of cell groups and entire organisms, more specifically, in accordance with at least one of the following points:

- Analysis of living cells in a 3D environment whose neighboring cells sensitively react to laser illumination and which must be protected from the illumination of the 3D-ROI [regions of interest];
- Analysis of living cells in a 3D environment with markers, which are subject to targeted 3D bleaching by laser illumination, e.g. FRET experiments;
- Analysis of living cells in a 3D environment with markers, which are subject to targeted bleaching by laser illumination, and at the same time, are also to be observed outside of the

ROI, e.g., FRAP and FLIP experiments in 3D;

- Targeted analysis of living cells in a 3D environment with markers and pharmaceutical agents, which exhibit manipulation related changes by laser illumination; e.g., activation of transmitters in 3D;
- Targeted analysis of living cells in a 3D environment with markers, which exhibit manipulation related changes in color by laser illumination; e.g., paGFP, Kaede;
- Targeted analysis of living cells in a 3D environment with very weak markers, which require e.g., an optimal balance in confocality against detection sensitivity.
- Living cells in a 3D tissue group with varying multiple markers, e.g. CFP, GFP, YFP, Ds-red, Hc-red and such similar.
- Living cells in a 3D tissue group with markers, which exhibit function related changes in color, e.g., Ca+- marker.
- Living cells in a 3D tissue group with markers, which exhibit development related changes in color, e.g. transgenic animals with GFP
- Living cells in a 3D tissue group with markers, which exhibit manipulation related changes in color by laser illumination, e.g., paGFP, Kaede
- Living cells in a 3D tissue group with very weak markers, which require a restriction in confocality in favor of detection sensitivity.
- The last mentioned item in combination with the one preceding it.

12. Use of configurations in accordance with at least one of the preceding claims for the analysis of intracellular transport processes, in particular for the representation of small motile structures, e.g., proteins with high speeds (usually in the range of hundredths of seconds), in particular, for applications such as FRAP with ROI bleaching.

13. Use of configurations in accordance with at least one of the preceding claims for the representation of molecular and other subcellular
interactions, specifically for the representation of very small structures with high speeds,

preferably while using indirect techniques such as e.g., FRET with ROI bleaching for the resolution of submolecular structures.

14. Use of configurations in accordance with at least one of the preceding claims for rapid signal transmission processes, in particular of neurophysiological processes with high temporal resolution, since the activities mediated by ions transpire within the range of hundredths to smaller than thousandths of seconds, in particular for analyses in the muscle system and in the nervous system.

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